



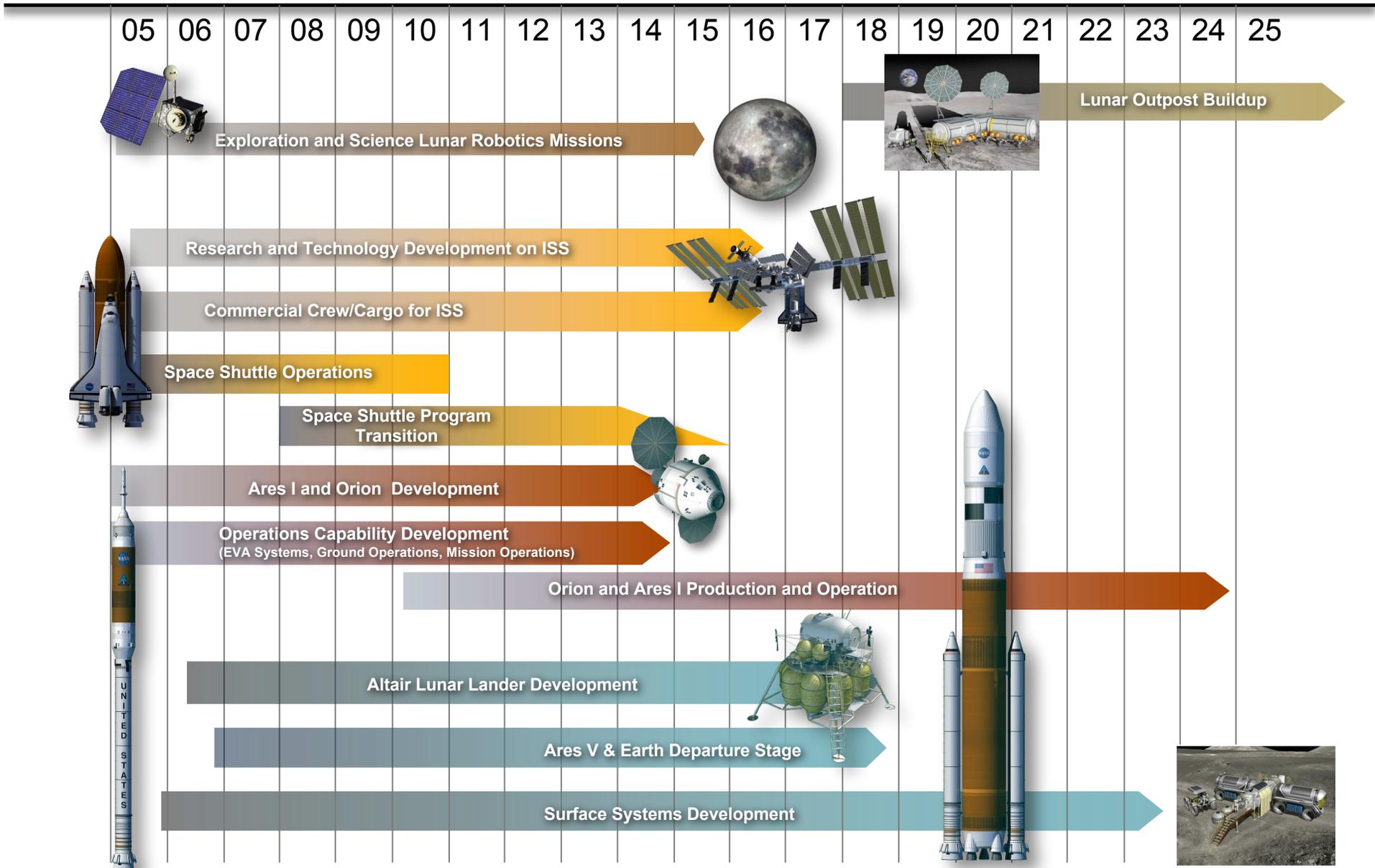
3RD SPACE EXPLORATION CONFERENCE & EXHIBIT

Exploration Update

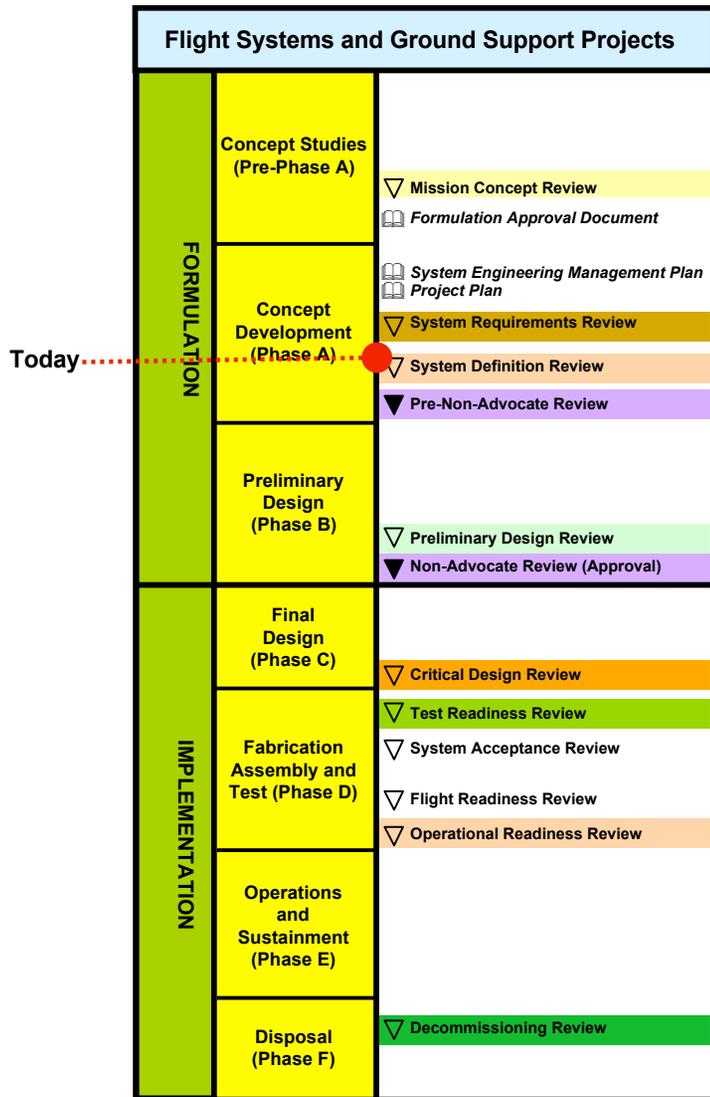
Dr. Richard Gilbrech
Associate Administrator for
NASA's Exploration Systems Mission Directorate

Date: February 26, 2008

Exploration Roadmap



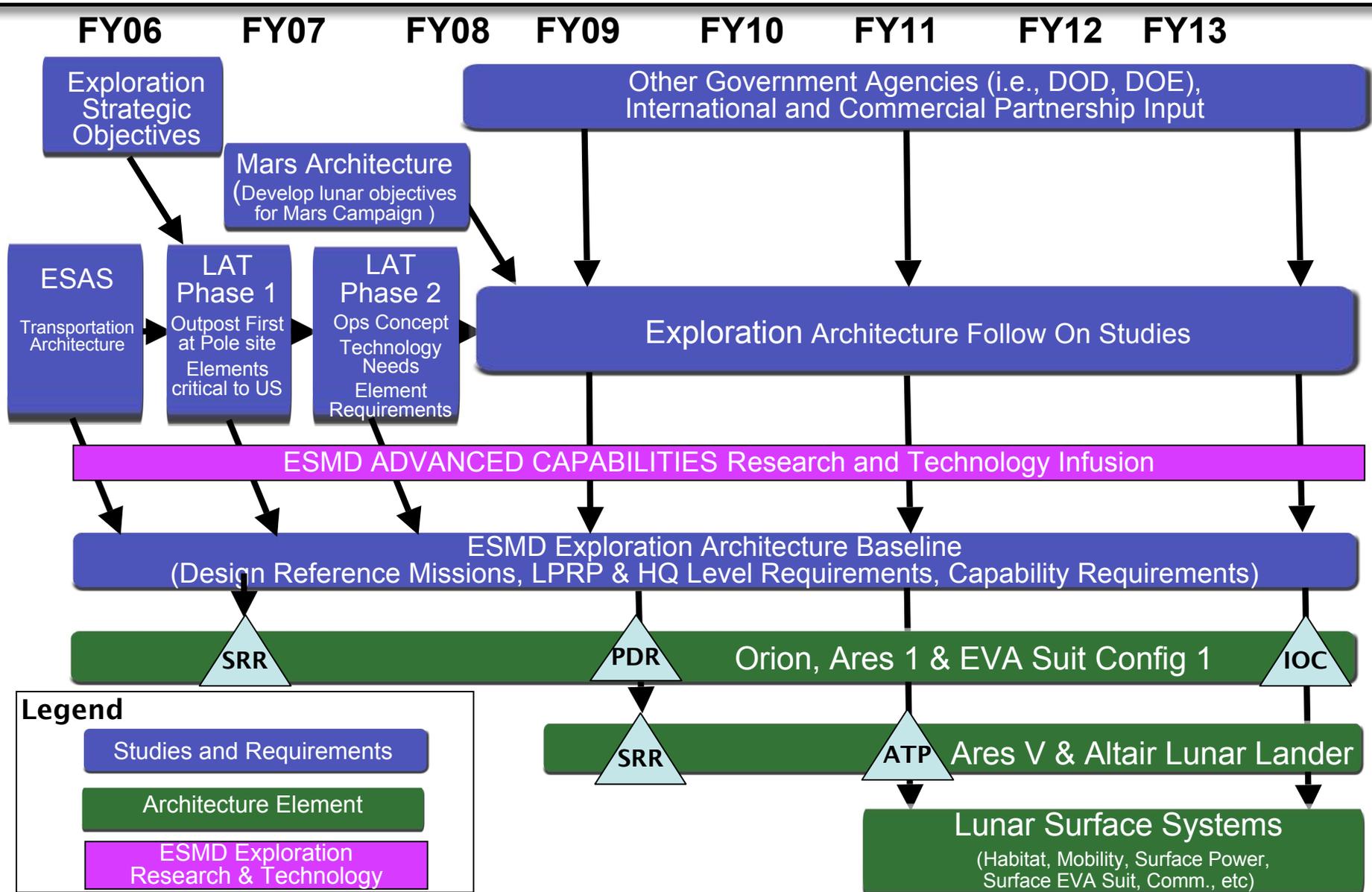
Exploration Systems Continues to Translate Plan Into Reality



- NASA is moving from conceptual studies towards Preliminary Design Review (PDR) as required by our Program Management Framework.
- Completed a “season of System Requirement Reviews (SRR’s)” for the Constellation systems in May 2007
- Kicked off a “season of System Definition Reviews (SDR’s)” with the Orion SDR in August 2007
- Orion/Ares I main components are under contract - December 2007
- Lunar Reconnaissance Orbiter (LRO)/ Lunar Crater Observation and Sensing satellite (LCROSS) scheduled launch in late calendar year 2008
- Pad Abort 1 test: September 2008
- Ares I-X launch: April 2009



Exploration Architecture Development



2009 Budget Request Highlights



- **We continue to do what we said we would do within budget and commitment milestones**
- **Constellation content reflects significant program maturity:**
 - Requirements formulation complete heading into Systems Definition Review (SDR)
 - Ares and Orion Projects completed Systems Requirements Review and Systems Definition Review (SDR) in 2007 and heading toward Preliminary Design Review (PDR) in CY 2008
- **Restores full funding for cargo demonstration of Commercial Space Transportation Services**
- **Supports start of Constellation Lunar Phase development in 2011 to achieve Human Lunar Return as quickly as possible (FY 2020 commitment)**
- **Supports Lunar Reconnaissance Orbiter (LRO)/Lunar Crater Observation and Sensing Satellite (LCROSS) launch in late CY 2008**
- **Technology and Human Research content prioritized and aligned to Constellation, Lunar Architecture Team, and Office of the Chief Health & Medical Officer requirements**
- **Continues Utilization of the International Space Station for Exploration and Non-Exploration Research**

A year of Acquisition Progress



- **Ares I Crew Launch Vehicle**
 - July 2007, negotiated and awarded Design Development Test & Engineering (DDT&E) contract with Pratt & Whitney Rocketdyne for Ares I upper stage engine
 - August 2007, negotiated and awarded DDT&E contract with ATK Thiokol for Ares I first stage
 - February 2007, competitive Request For Proposal (RFP) released for Ares I upper stage production released, awarded to Boeing end of August 2007
 - June 2007, competitive RFP for Ares I upper stage avionics production released, awarded to Boeing Dec 2007
- **Space Suit System**
 - July 2007 issued Draft RFP. Released RFP in October 2007, award planned June 2008
- **Altair Lunar Lander**
 - Concept Development Broad Area Announcement Release: January 11, 2008, award planned for early March 2008
- **Commercial Crew Cargo Program (C3P)**
 - One Partner has completed first eight milestones on schedule
 - Now have one funded and five unfunded Partners;
 - Orbital Science Corp. was selected as a Space Act partner Feb 19, 2008
- **Plans for 2008:**
 - Ground Operations Processing Contract RFP Release: Summer/Fall 2008
 - Integrated Mission Operations Contract (IMOC). Facilities Development & Operations Contract (FDOC): Both awards planned October 2008

Acquisition Update



	<u>Company</u>	<u>Date awarded</u>
• Orion	The Lockheed Martin logo, consisting of the words "LOCKHEED MARTIN" in a sans-serif font followed by a stylized blue starburst graphic.	August 2006
• J2-X	The Pratt & Whitney logo, featuring a sunburst icon, the text "Pratt & Whitney", "A United Technologies Company", and "Pratt & Whitney Rocketdyne" below it.	July 2007
• 1 st Stage	The ATK logo, with the letters "ATK" in a bold, italicized sans-serif font inside a blue oval.	August 2007
• Upper Stage	The Boeing logo, featuring a stylized blue "Q" symbol followed by the word "BOEING" in a bold, italicized sans-serif font.	August 2007
• Instrumental Unit Assembly (IUA)	The Boeing logo, featuring a stylized blue "Q" symbol followed by the word "BOEING" in a bold, italicized sans-serif font.	December 2007

Shuttle Transition & Retirement



- **Cx transition strategy is to have lunar projects (e.g. Ares V, Lunar Lander) fully underway as soon as possible**
- **Significant agency effort made during FY 2007 to understand complexity of problem**
 - Cx requirements refined: SRR complete, SDR initiated
 - Human Space Flight Capability gaps identified
 - Substantial program (Shuttle, Station, Cx, C3) and institutional cooperation
- **Major gaps/threats addressed during this budget formulation process and effort continues**
 - Shuttle to Constellation Workforce Mapping (both Civil Service & Contractors) nearing completion to be followed by strategy development
 - Property disposal and Facilities/Infrastructure analysis on-going
 - Development of separate Cx operations budget line, division between ESMD and SOMD budgets premature at this time; anticipate greater fidelity available in next budget process

2007: Technical Progress Orion and Ares I



Ares I-X USS Pathfinder



Ares I Interstage Mockup



PA-1 Crew Module Boilerplate Assembly



J2X/RS-68 Igniter Tests



J2X Altitude Test Stand Construction



Orion Landing System Tests



Orion Parachute Tests

2007: Technical Progress Operations Capabilities



Ground Operations: "Young - Crippen" Firing Room 1



**Ares I Pad B Lightning Protection
Modifications**



**Orion Standalone Processing Facility
Mods (O&C Facility)**

ETDP Technical Highlights



Developed compliant “Tweel” for ATHLETE rover



Demonstrated 11:1 throttling of RL-10 engine for Lunar Lander descent stage



Fabricated prototype 5 meter diameter PICA heat shield for Orion



Developed six-wheeled chassis for pressurized rover



Demonstrated deployment of solar power system for lunar outpost in Desert RATS field test

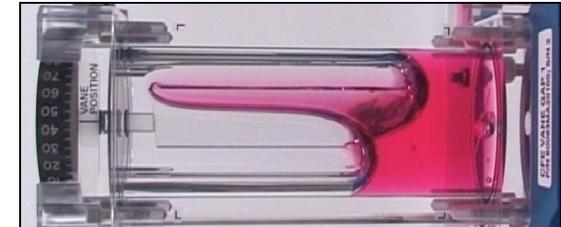
ETDP Technical Highlights



Demonstrated oxygen production from simulated lunar regolith



Conducted the Smoke and Aerosol Experiment (SAME) on the ISS



Discovered new fluid behavior in microgravity using Capillary Flow Experiment on the ISS



Demonstrated hydrogen-air fuel cell power system for ATHLETE rover that can carry large payloads over rough terrain



Fabricated proof-of-concept inflatable habitat for lunar outpost



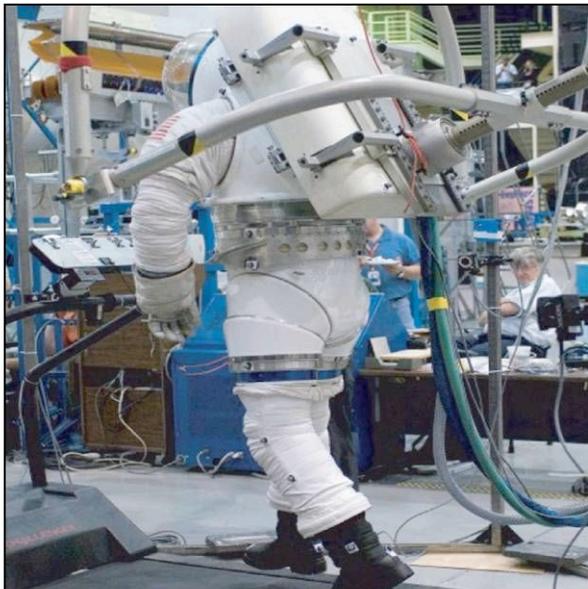
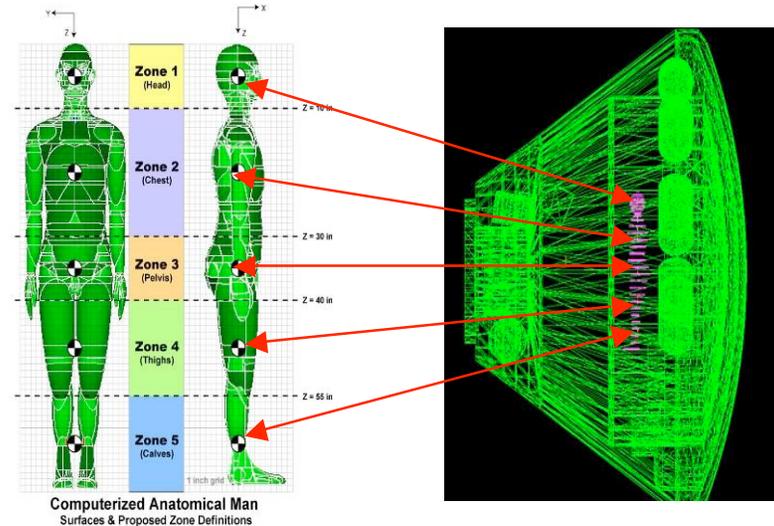
Developed lithium-ion battery for powering portable life support system on EVA suit

HRP Research Highlights



Space radiation exposure cannot be eliminated, only reduced to safe levels.

HRP developed radiation shielding design tools are being used in CEV design analysis cycles to assess exposure levels inside the spacecraft.



A key capability to enable human exploration missions is the ability to conduct safe and productive Extra-vehicular Activities (EVA).

By measuring human physiological performance, HRP is evaluating space suit designs to enable contingency walk-back capability, optimize Lunar EVA operational scenarios, and minimize physiological exertion for Constellation EVA systems.

HRP Research Highlights



Longer term spaceflight has a number of effects on the bodies cardiovascular system, muscle strength, and other physiological systems that impact astronaut fitness

Using the ISS, HRP is developing a systemic measure of overall fitness based on oxygen uptake measurements that takes into account all physiological changes during spaceflight



Astronaut Sunita L. Williams, Expedition 15, exercises on the Cycle Ergometer during a Periodic Fitness Evaluation with Oxygen Uptake Measurement experiment



Expedition 14 Astronaut Mike Lopez-Alegria storing samples for the Nutrition Experiment in the U.S. Laboratory/Destiny

Research to inform development of a microbiological standard for long-duration exploration missions is important to crew health and safety

NASA is undertaking the SWAB experiment that investigates spaceflight effect on microbes and comprehensively evaluates microbes on board the ISS, including pathogens (organisms that may cause disease), using advanced molecular techniques

LPRP Technical Highlights



LRO: Flight Propulsion Module lift into vibration test facility



LRO: Installation of Thrusters to Flight Propulsion Deck



LCROSS: Attaching Fuel Tank and Aft Skirt to ESPA Ring

FY '08 Challenges Ahead



- **Programmatic**
 - LRO/LCROSS scheduled for end of year launch
 - Integrated Program Management – Performance, Schedule, Budget, Risk
 - Orion point of departure (landing mode, abort system, weight margins)
 - Ares thrust oscillation
 - Ares 1-X Launch preparation
 - Robotic lunar lander program development with Science Mission Directorate

Summary



- **ESMD continues to deliver as promised**
 - Major work is underway
 - Contracts are in place
 - Our plan is executable
- **NASA has planned and paced the multi-decade Constellation program to live within its means, while carefully identifying and mitigating the threats to mission success**
- **Congress's continued support in FY 2009 will be critical to ensuring that the strategic direction of the exploration vision can be sustained**
- **This program will drive us toward new technologies; will enable a new area of economic activity; will strengthen our national security; will engage our technical and engineering workforce; will provide an opportunity to collaborate on important missions with our international partners; and will inspire a new generation of scientists and engineers**